Information

Prosthetic Replacement of the Aortic Valve: A Current Assessment of Operative Results

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IN THE ADULT PATIENT with clinically significant aortic stenosis or aortic regurgitation, the aortic valve is always severely deformed, frequently lacking in substance, and usually the site of dense calcification. In the past, attempts were made to restore function to such valves by debridement, commissurotomy or other reconstructive procedures, but experience has shown that these operations are ineffective in providing lasting benefit. Thus, when operative treatment becomes necessary in the adult with acquired aortic valve disease, it must be assumed that total replacement of the valve will be necessary.

The Starr-Edwards prosthesis has been most widely utilized for aortic valve replacement, and between February 1963 and September 1967 it was employed in 175 patients undergoing valve replacement at the National Heart Institute. The early and late results of operation in these patients are summarized in the present report.

The Patients

The 175 patients were 16 to 68 years of age (mean 47 years); 136 were men and 39 women. All were distinctly symptomatic; 36 were in functional Class II (New York Heart Association Criteria), 123 in Class III, and 16 in Class IV. The patients in Class II were all severely limited by episodic angina pectoris or syncope or both. On examination, the usual physical, roentgenographic and electrocardiographic findings associated with aortic valve disease were present. All patients were studied preoperatively by cardiac catheterization and selective angiography. Pure or predominant aortic stenosis was present in 76 patients, and pure or predominant aortic regurgitation in 59 patients. In 40 patients stenosis and regurgitation were considered of similar severity. Thirteen patients had defective aortic prostheses of other types, and four had aneurysms of the ascending aorta which necessitated resection or aneurysmorrhaphy. Excluded from present consideration are other patients in whom aortic valve replacement was accompanied by an operation on the mitral or the tricuspid valve or both.

The aortic valve was exposed during total cardiopulmonary bypass conducted during mild (30°C) general hypothermia. The left coronary artery was perfused. The diseased valve and any residual calcific deposits in the annulus and septum were resected, and a prosthesis of suitable size inserted. The valves were those available at the time, and they had silastic poppets and bare metal struts and orifices (Models 1000 or 1200). In virtually all patients anticoagulation with warfarin was instituted in the early postoperative period and maintained thereafter.

The Results

Immediate Mortality. Twenty-four patients (14 percent) died during the hospital admission at which valve replacement was performed. Nine patients died in the operating room, five as a result of technical problems related to placing the valve or closing the aorta; four other patients could never sustain an effective circulation after bypass, and one of them was found at necropsy to have severe and unrecognized mitral stenosis. Postoperatively, fatal hypotension and low output occurred in three patients, possibly because the prosthesis was too large for the aorta. Five patients died of uncontrollable ventricular arrhythmia, and three of renal failure. Cerebral hemorrhage, infected aortotomy, pulmonary consolidation, and endocarditis caused one death each.

Late Mortality. Thirty-eight of the original 175 patients (22 percent) have died at intervals of three months to five years after operation. In ten patients death was sudden and unexpected, and no anatomic cause was apparent at necropsy. Ten other patients have died as the result of degeneration of the silastic ball. The remaining 18 patients died of various causes, including left ventricular failure, arrhythmia, myocardial infarction, endocarditis and hepatitis.

Thromboembolism. Since 1965, all patients with Starr-Edwards valves have been given therapeutic doses of warfarin unless a specific contra-

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indication existed. Twenty-eight of the 113 surviving patients have had a total of 31 cerebral emboli with definite neurologic abnormalities. Twenty-five of the 28 patients recovered without detectable neurologic sequelae; in two patients mild residual abnormality persists, and in the other moderate weakness of the arm prevents employment. A number of other patients have described brief episodes of vertigo, paresthesia or aphasia, but none has ever had a neurologic abnormality on examination. Two patients who died suddenly and unexpectedly were found at necropsy to have coronary artery emboli.

Eight patients have experienced bleeding as the result of warfarin administration, and two of them with intracranial bleeding (intracerebral or subdural) died.

Symptomatic Improvement. The 113 surviving patients have been followed for periods of one to five years (average 34 months) and detailed reassessments have been made in all. Eighty of the 113 survivors (71 percent) are asymptomatic (Class I), while the remaining 32 experience symptoms only during unusual activity (Class II).

Hemodynamic Improvement. Postoperative cardiac catheterization has been performed in 100 patients at an average interval of seven months postoperatively. A systolic gradient across the prosthesis was usually evident, but the average value at peak systole was only 12 mm of mercury. The left ventricular end-diastolic pressure exceeded 15 mm of mercury in 66 patients preoperatively; it fell postoperatively in all but four of these, and the value was greater than 15 mm in only 15 patients postoperatively. The cardiac index was usually normal both before and after operation in patients with aortic stenosis. In two-thirds of those with aortic regurgitation it was abnormally low preoperatively, and normal in all but three postoperatively.

Some Conclusions Concerning Aortic Valve Replacement

The immediate risk of aortic valve replacement is 10 to 15 percent, and a significant number of survivors may be expected to die later of causes directly or indirectly related to the operation or the prosthetic valve. Thus, at this time operation should only be recommended to distinctly symptomatic and severely incapacitated patients, those in whom the risk of early death without operation can reasonably be considered equal to or greater than that associated with valve replacement. In the child or adolescent, valve replacement is certainly to be avoided in all but extreme circumstances. The diagnosis of aortic stenosis or aortic regurgitation is readily apparent on clinical examinations, but information concerning the severity of the malformation can only be obtained by appropriate hemodynamic and angiographic studies. Such studies should be applied preoperatively in most patients, to provide assurance that symptoms are entirely or principally attributable to the defective valve and that improvement can be expected after valve replacement. When severe stenosis or regurgitation is proved to be present in a severely symptomatic patient, operation is always recommended. Certain preoperative findings, such as previous myocardial infarction, probably indicate an increased operative risk, but at this time none constitutes an absolute contraindication to operation.

Patients who survive operation derive gratifying symptomatic improvement, and in most of them this is accompanied by a return of the intracardiac pressures to normal or near-normal values.

These attitudes and conclusions concerning aortic valve replacement are based almost entirely on relatively early experiences with Starr-Edwards prostheses. Early mortality can certainly be reduced by more exact intraoperative and postoperative management, and almost two-thirds of the early deaths in this series could now be avoided. Also, valves used since September 1967 have metallic poppets, which should be indestructible, and fabric covering of the orifice and struts should eliminate or greatly reduce the incidence of systemic embolization. With these valves permanent anticoagulation therapy is considered unnecessary. When there is sound evidence that modifications of the operation and the prosthesis have reduced the risk of late death or disability, valve replacement can then be recommended to patients early in the course of their disease.

Attention Pediatricians!

Heinz Eichenwald, M.D., Professor of Pediatrics, University of Texas, Southwestern Medical School, will speak at the Pediatric Section meetings of the Annual Scientific Assembly, March 8 and 9. Plan to attend.